

A NEW CALIFORNIAN SPECIES OF TIMEMA
(PHASMODEA: TIMEMIDAE) WITH
ZOOGEOGRAPHICAL NOTES

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The discovery of a fourth and new species of *Timema* Scudder (1895) from California, and the fifth for the genus, adds new interest to this unusual and archaic insect genus. *Timema* is of considerable zoogeographical interest in that it appears to be a relict member of an almost extinct fauna that was formerly widespread throughout the region of the Southwest. The advent of the desert was probably responsible for extirpation of much of this ancient fauna and today only remnants survive in Arizona. This same fauna is much more widespread in southern California.

One of the facts substantiating this statement is *Timema* itself. Formerly known only from the western slopes of the mountains of southwestern California, a new species of *Timema* was recently described from southeastern Arizona. This was found on the summit of Mt. Wrightson (9,432 feet in height) of the Santa Rita range, some 45 miles southeast of Tucson, by Mr. Robert Flock of the Entomology Department of the University of Arizona. Mr. Morgan Hebard named this *Timema ritensis*, in 1937. Since that time Mr. Owen Bryant has taken this species at high elevations in the Santa Catalina Mountains some 60 miles north of Mt. Wrightson. Because of the antiquity of the genus there is a possibility that *T. ritensis* or new species may be found in the Pinal Mountains, the chaparral country west of Prescott or in the Hualpai Mountains, in areas typical of its environment in California and southeastern Arizona. Certain mountain ranges in southern Nevada probably contain unknown species of *Timema*. Thus in time we may expect to have a series of *Timema* species whose composite distribution will extend from southeastern Arizona to southwestern California and which will represent piers of the ancient land bridge connecting these two areas faunistically in the palaeohistory of the Southwest.

Much the same zoogeographical feature is exhibited by the small, short antennaed, narrow-faced grasshoppers belonging to the family Eumastacidae. The discovery of a new genus of Eumastacids by Dr. E. D. Ball from the mountains of southeastern Arizona and named *Eumorsea balli* by Hebard in 1937,

lends further support to the existence of this ancient fauna. *Eumorsea* is now known from the Santa Rita, Pinaleno and Huachucas Mountains, the latter being the type locality. Two other Eumastacid genera are known, *Morsea* from northwestern Arizona to southern California and *Psychomastax*, discovered on Mt. Charleston, ranging from southwestern Nevada to California. Thus we see that *Eumorsea* is probably a connecting link between the Nearctic Eumastacidae as represented by *Morsea*, *Psychomastax* and *Eumorsea* and the many other genera such as *Eumastax*, *Lethus*, *Episactus*, etc., of the Neotropical world. The discontinuous distribution represented by *Timema* and the three Nearctic Eumastacid genera are living representatives of a former ancient fauna extending from southeastern Arizona to southwestern California.

Further the discovery of a new species of *Timema* from the edge of the desert in California affords evidence as to the ability of this genus to adapt itself to changing climatic conditions. It is highly probable that additional new species of *Timema* will come to light in southern California and central Arizona as interest increases and more exhaustive insect surveys are made in these regions.

The writer wishes to thank Dr. Bohart of the Entomology Department of the University of California in Los Angeles for permission to study the types of the new species. To Dr. W. Dwight Pierce, Entomologist of the Los Angeles County Museum especial thanks are due for submitting to the writer a large collection of *Timemas* from which interesting notes on taxonomy, distribution and host plants have been made to augment our present knowledge of the genus.

Key to the Males of TIMEMA Scudder

1. Dextral cercus with an acute apex2
 Dextral cercus with a divided apex3
2. Intra-dextral process with small teeth on the outer margin with process above base narrowed to blunt apex. Sinistral cercus very broad in middle and base *boharti* n. sp.
 Intra-dextral process without teeth but with large rounded hump on the outer margin with process above base bluntly triangular. Sinistral cercus narrow at base with moderately large interno-median arcuate flange *podura* Strohecker
3. Dextral cercus with acutely bifurcate apex. Intra-dextral process more or less straight, not strongly incurved..4

- Dextral cercus with rounded bifurcate apex. Intra-dextral process angled and strongly incurved sinistral with broad truncate apex *ritensis* Hebard
4. Sinistral cercus with one large interno-median spur. Apex of intra-dextral process not squarely truncate but acute with its outer margin devoid of teeth *chumash* Hebard
- Sinistral cercus with small interno-basal and subapical teeth. Apex of intra-dextral process squarely truncate and outer margin armed with a few scattered teeth *californicum* Scudder

Key to the Females

1. Penultimate tergite produced 2
 Penultimate tergite not produced but short and evenly rounded with slight central sinuation. Subgenital plate with apex well rounded. Size very large *boharti* n. sp.
2. Distal margin feebly bilobate. Subgenital plate almost flat, broad and acutely pointed. Color greenish..... *californicum* Sc.
 Distal margin not feebly bilobate but convex or truncate 3
3. Distal margins rather broadly truncate. Subgenital plate strongly convex, acutely pointed with apex narrowly rounded. Coloration buffy profusely flecked and mottled with light gray and black *podura* Strohecker
 Distal margin convex or narrowly rounded. Subgenital plate moderately narrow with acute apex slightly rounded. Coloration green *chumash* Hebard

The female of *T. ritensis* Hebard has not been described.

The literature and distribution of the various species is reviewed below with new notes added from the *Timema* material assembled by the Los Angeles County Museum.

TIMEMA CALIFORNICUM Scudder (Plate 14, fig. 6):

1895. *Timema californicum* Scudder. Can. Ent. 27:30 (Santa Cruz, Cal.).

1903. *Timema californicum* Caudall. Proc. U. S. Nat. Mus., 26:883, pl. 67, fig. 5, pl. 68, fig. 7 (in pt.) (♂, ♀, Santa Cruz Mts., Cal.).

1903. *Timema californica* Caudell. Ent. News, 14:316 (juv. ♀, Humboldt Co., Cal.).

1908. *Timema californicum* Redtenbacher. Insektenfam. Phasmiden, p. 88 (no additional mat.).

1913. *Timema californica* Caudell. Proc. U. S. Nat. Mus., 44:613 (no new mat.).

1920. *Timema californicum* Hebard. Ent. News 31:127, fig. 1.

1937. *Timema californicum* Hebard. Trans. Amer. Ent. Soc., 63:349 (Ross, Marin Co., Cal.).

Hebard in 1920 listed many new localities for this species.

Los Angeles County Museum material: 9 ♀, 3 ♀ nymphs, Pine Canyon, California, June 1-22, 1941 (C. Henne; on *Cercocarpus* and *Ceanothus*). The measurements for these specimens fall within the range given by Hebard as: males, body length 12.5-14.5 mms., pronotum 1.9-2.7 mms., and caudal tibiae 3.4-3.7 mms.; females, body length 17.7-20.8 mms., pronotum 2.4-3.1 mms., and caudal tibiae 4.2-6.0 mms.

Specimens in the Los Angeles County Museum collection, especially prepared to retain their natural colors are a beautiful viridian. Some specimens show a divergence towards the females of *T. chumash* by the obliteration of the feebly bilobate apex of the penultimate tergite which is supposed to characterize this species. The females of this species are further characterized from those of *chumash* by the broader head and pronotum which has the lateral margins less convergent forward. The head viewed in lateral profile is more strongly convex and raised above the level of the eye, than observed in *chumash*.

The range of this species is now known to extend from Bair's Ranch on Redwood Creek in Humboldt County southward to Monterrey and Los Angeles County. It has also been taken in the Sierra from Kings River in Fresno County and the vicinity of Lake Tahoe. *Ceanothus* and Mountain Mahogany *Cercocarpus* and fir trees are the known hosts of this species.

TIMEMA CHUMASH Hebard (Plate 14, fig. 4):

1903. *Timema californica* Caudell, (in pt. not of Scudder 1895). Proc. U. S. Nat. Mus., 26: 883, pl. 58, fig. 7a (♂, ♀ Los Angeles Co.).

1920. *Timema chumash* Hebard. Ent. News, 31: 130131, fig. 2 (♂, ♀ Los Angeles Co., Cal.).

1937. *Timema chumash* Hebard. Trans. Amer. Ent. Soc., 63: 349 (San Jacinto Mts.).

Los Angeles County Museum Material: 5 ♀, Bouquet Canyon, Los Angeles Co., June 12, 1938 (L. M. Martin). 2 ♂ nymphs, 4 ♀ nymphs, Cloudburst, Los Angeles Co., Aug. 7, 1941 (C. Henne; *Quercus dumosa*). 1 ♀, Baldy Mesa, Cajon Pass, San Bernardino Co., June 13, 1937 (J. A. Comstock).

One of the females from Bouquet Canyon has a slight emargination in the penultimate tergite and is practically indistinguishable from females of *T. californicum* although the head and pronotum in this species is narrower and the head above the eyes shallower. In the male nymph a semitransparent integumentous fold encloses the dextral cercus and the intradextral process and also a similar fold covers the sinistral cercus. By careful examination of the underlying structure, the species of the male nymph, if not too small, can be determined.

Hebard gives the following measurements for this species: males, body length 13.5-14.0 mms., pronotum 2.4-2.4 x 3.0-3.7 mms., caudal tibiae 4.0-4.3 mms.; females, length 20.0-21.0, pronotum 2.7-3.0 x 3.9-4.0 mms., caudal tibiae 4.8 mms.

T. chumash is known from the mountain systems of Los Angeles County east to the edge of desert at Palm Springs and northeast to Cajon Pass.

Quercus dumosa appears to be the only known host plant.

TIMEMA PODURA Strohecker (Plate 14, fig. 3):

1936. *Timema podura* Strohecker. Ent. News, 267, fig. 1 and 2.

Los Angeles County Museum material: 1 ♂, 1 ♀, 1 ♀ nymph, Keen Camp, San Jacinto Mts., California, May 17-June 12, 1939 (J. G. Shanafelt; on *Ceanothus*). 1 ♂, Los Angeles Co., (J. A. Comstock). 3 ♀, Pine Canyon, Los Angeles Co., June 22, 1941 (C. Henne; on *Cercocarpus*). 1 ♂ nymph, 3 ♀, 3 ♀ nymphs, Pine Cove, San Jacinto Mts., California, May 23, 1939 (J. G. Shanafelt).

The general coloration of the females is buffish, profusely flecked with pale gray and heavily mottled with irregular black streaks and markings. The male is more yellowish with the dorso-lateral abdominal stripe and the thoracic markings black suffused with lighter flecking over the entire body surface.

Measurements for this species are as follows: males, body length 13-14 mms., pronotum 2.0-2.1 x 2.7-2.9 mms., caudal tibiae 3.4-4.0 mms.; females, body length 18.4-22.0 mms., pronotum 2.5-2.9 x 3.2-3.9 mms., caudal tibiae 3.4-4.0 mms.

Formerly known only from the Sequoia National Park and the Greenhorn Mountains the new records reported above extend the range of *T. podura* south through the southern Sierra Nevadas to the San Jacinto mountains.

The new records also provide us with the first information on the host plant of this species. These are *Ceanothus* or Buck Brush and *Cercocarpus*, the Mountain Mahogany, two common shrubs of the Californian mountains.

TIMEMA RITENSIS Hebard (Plate 14, fig. 2):

1937. *Timema ritensis* Hebard. Trans. Amer. Ent. Soc., 63:349, Pl. 21, fig. 1 (summit Mt. Wrightson, Santa Rita Mts.).

The discovery of *Timema* in southeastern Arizona came as a distinct surprise. This interesting species, known as yet only in the male sex, was found on the narrow rocky summit of Mt. Wrightson of the Santa Rita Mountains at an elevation of 9,432 feet. Mr. Robert Flock of the Entomology Department of the University of Arizona found it on the steps of the lookout cabin. Since its discovery Mr. Owen Bryant of Tucson has collected several specimens from high elevations near Mt. Lemmon in the Santa Catalina Mountains north of Tucson. Size of male type: body length 12.7 mms., pronotum 2.0-3.7 mms. in width, caudal tibiae 4 mms. The host plant of this species is not known.

TIMEMA BOHARTI n. sp. (Plate 14, figs. 1 and 5):

A large species showing closest relationship to *T. podura* Strohecker and distinguished in the male sex by its very large size and striped grey coloration. The male genitalia is quite distinct from all the other species. Left or sinistral cercus very broad in the middle; right or dextral cercus arcuate with acutely pointed apex somewhat similar to that in *podura* but quite distinct from the bifurcate apices of *californicum* Scudder and *chumash* Hebard and the bilobate apex of *ritensis* Hebard. The intra-dextral process is quite distinct from the four known species. The female is distinguished by its very large size and grey striated appearance, and the short convexly rounded penultimate tergite of the abdomen with a slight central sinuation in its posterior margin.

Holotype: ♂, Borrego Desert, March 23, 1941 (James Oetzel; collected in grass). Measurements: body length 17.0; pronotum 2.2 x 3.5 broad; caudal femur 3.8; caudal tibiae 4.0 mms. Male taken "in copulo" with female type. Holotype deposited in the collection of the Entomology Department of the University of California in Los Angeles.

Description: Form normal, head broad and flat with small, circular, faceted, weakly globular eyes. Antennae placed well in front of the eyes, the basal segment large. Internal margin of the antennal sockets strongly and smoothly keeled running posteriorad to near the internal margin of the eyes. Pronotum about one and one-fourth times as broad as long; greatest breadth at the posterior angles; sides straight. Mesonotum narrower than the pronotum with gently convex sides. Metanotum with lateral margins strongly convex; wing scars evident on the meso- and metanota. Abdomen narrowing apically, considerably narrower than the nota.

Genitalia: Sinistral cercus broadest in the middle and apically well rounded; internal margin with large medio-internal flange with apex well rounded and bearing ventrally a rounded ridge. A small internal basal swelling on the dorsal surface indicates the remains of a tooth. Dextral cercus arcuate with broad, acutely terminated apex and with a medio-dorsal ridge. Internal process of dextral cercus flat and broad, internal margin concave, outer margin convex in basal half with 3 or 4 small prominent teeth in the apical half. Apex blunt with deflexed rounded process. Supra-anal plate minutely triangular and located near the base of the left cercus. Subgenital plate with apical margin strongly convex. Ventral keels of all femora smooth; ventral keels of all tibiae unspined but hairy; limbs heavy for the genus.

Coloration: Dorsum of body glossy and smooth, pale grey with fine striations of dark grey running longitudinally of the body. Ventral surface pale grey with paired grey stripes laterally on each segment. Legs pale grey with heavy black marks apically and basally on the caudal femora and caudal tibiae respectively and scattered dots on the dorsum of the caudal tibiae. Antennae pale brownish.

Allotype: Same data as holotype and taken "in copulo" with it.

Measurements: Body length 29.0, pronotum 3.0×4.2 broad, caudal femur 4.0, caudal tibiae 4.5, antennae 14 mms. Allotype deposited with the holotype.

Description: Paler and duller than the holotype, striated with purplish grey in pattern similar to that of the male type. Antennae more speckled than in the type with 22 segments beyond the long basal segment; segments 3 to 9 small and segments 10 to 22 elongate. Ventral surface pale pinkish grey with sparse speckling of grey. Sternites with pit-like depressions between the middle and hind legs. Aside from its much larger size the female is closely similar to the male.

Genitalia: Supra-anal plate with a slight central sinuation on the posterior margin; antepenultimate segment with posterior margin truncate. Subgenital plate with lateral margins parallel in the basal half, then strongly converging to a well rounded apex. Cerci very large and broad with the internal dorsal and ventral margins minutely serrate. Valvulae strongly recurved in the apical portion, acuminate pointed and hidden under the subgenital plate.

This species is named in honor of Dr. Bohart of the Department of Entomology of the University of California in Los Angeles who has most kindly permitted the author to study and describe this new form.

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Strohecker

1936. The genus *Timema* Scudder, with the Description of a New Species (Orthoptera, Phasmidae, Timeminae). Ent. News, 47: 126-132, figs. 1 & 2.

EXPLANATION OF PLATE 14

See page 80.

(All figures greatly enlarged)

1. *Timema boharti* n. sp. Male Holotype. Borrego Desert, California. Dorsal view of male genitalia.
2. *Timema ritensis* Hebard. Male. Type. Old Baldy (Mt. Wrightson), Santa Rita Mts., Arizona. Dorsal view of distal portions of abdomen and its appendages (enlarged and redrawn after Hebard).
3. *Timema podura* Strohecker. Male. Type. Sequoia National Park, California. Dorsal view of male genitalia enlarged and redrawn after Strohecker.
4. *Timema chumash* Hebard. Male. Type. Los Angeles County, California. Dorsal view of male genitalia enlarged and redrawn after Hebard.
5. *Timema boharti* n. sp. Female. Allotype. Borrego Desert, California. Lateral view of apex of abdomen and terminal organs.
6. *Timema californicum* Scudder. Male. Type. Santa Cruz, California. Dorsal view of male genitalia, enlarged and redrawn after Hebard.

THE PRESERVATION OF COLOR IN SOFT ORTHOPTERA

By W. DWIGHT PIERCE

In the foregoing article on *Timema*, Mr. Tinkham refers to the preservation of the green color in *Timema californicum*.

When this beautiful green species is killed and dried normally it shrivels up and the green is largely lost. The insects are very soft, and one desires to keep not only the full form but also the color.

When they are killed in cyanide and then placed in alcohol, it only takes a few hours to completely remove all of the green. If placed in 70% alcohol for one hour, 95% alcohol one hour, and xylol 24 hours; or placed in xylol only for 24 hours, we retain not only form but color. For this reason it is now our policy to use this method for all green soft bodied insects.

For *Stenopelmatus* with no perishable colors, we run the specimens through the three solutions for 24 hours each and then pin.